A STUDY OF THE ANATOMY OF PHALÆNOPTILUS, RIDGWAY.[1]

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(PLATES IV, V AND VI.)

INTRODUCTION.

The present paper is a contribution to the knowledge of *Phalæ-noptilus nuttalli nitidus* (Brewster), the Poorwill, and presents an account of the alimentary, respiratory and urogenital organs, the central nervous system and all the muscles of the anterior extremity and those of the thigh.

As generally defined now the Caprimulgi include the three families of Steatornithidæ, Podargidæ and Caprimulgidæ. In regard to their distribution Fürbringer (1888) says that the Caprimulgidæ represent the largest family (some 100 species) and with almost cosmopolitan distribution (exclusive of New Zealand, the pacific subregion and the southern part of South America) ; the Steatornithidæ, represented by a single species, occur in caves in the tropical Andean region and the West Indies ; the Podargidæ consisting of about 20 species inhabit the oriental region, particularly New Holland and Papuasia. Of the Caprimulgidæ the following genera occur in North America : *Antrostomus, Phalænop-*

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tilus, Nyctidromus and *Chordeiles.* Of these genera *Phalænoptilus* extends from Guatemala northward in the western United States nearly to British Columbia, and is represented by three geographical races of one species. This genus was first established by Ridgway (1880), and is defined as follows by Coues (1903) : "Nostrils tubular, cylindrical, opening forward and outward. Rictal bristles immense, but simple. Tarsus naked except just on the joint above (as in *Nyctidromus*), as long as middle toe without claw. Tail square, much shorter than the rounded wings, which fold nearly to its end." No anatomical description of this genus has heretofore appeared so far as the writer knows.

The aim of this study is the interesting question of the homologies of the Caprimulgi. Fürbringer (*l. c.*) discusses at length the varying views on their relationship to Ardeidæ, Glareolidæ, Strigidæ, Cuculidæ, Galbulidæ, Trogonidæ, Coraciidæ, Leptosomidæ, Todidæ, Momotidæ, Coliidæ, Cypselidæ, Trochilidæ and Passeres (*Eurylæmus, Hirundo*), and sums up his position in these words : "On the ground of the given comparisons, I am inclined to regard the Caprimulgidæ, Steatornithidæ and Podargidæ as independent but closely related families, and as united under Caprimulgi ; they stand in remarkable genealogical relations in the first line to the Striges and Coraciæ and in the second to the Trogonidæ and Cypselidæ, while the relation to the other families coming in question is less near and direct." Gadow (1891), considers the Caprimulgi as related ancestrally to the Striges and laterally first with the Coraciæ and second with the Cypseli. It soon became apparent to the writer that this problem of affinities could not be settled by the investigation of a single genus. Accordingly this paper is intended to be the first of a series dealing with these birds, and is essentially descriptive, general theoretical considerations being postponed until personal studies have been made upon other forms. Because there was not time to describe the whole anatomy it seemed advisable to omit the osteology, since most of the previous work has been done upon the skeleton.

Special anatomical monographs upon such species of birds are so few, and yet so much needed, that it is hoped this one may be of some service to comparative anatomists.

The material used consisted of two entire adult females secured by Dr. Thos. H. Montgomery, Jr., in the month of June, 1904, in

Brewster County, Texas, one preserved in alcohol and the other in formalin.

This work has been done entirely under the direction of Dr. Montgomery, and I am very much indebted to him for many helpful suggestions, and for his unfailing sympathy and encouragement during the preparation of this memoir.

I. ALIMENTARY TRACT.

This bird is remarkable for its enormous *mouth*. Arranged in a regular series along the upper border of the gape there are on each side of the mouth eight long vibrissæ, modified feathers.

The *tongue* (*T*, Pl. IV., Fig. 10), is slender and pointed. Posteriorly it is bifid and fimbriated. The hyoid bone (Figs. 1 and 10) consists of the following parts : os entglossum (*Ent. g.*), basihyal (*Bas. h.*), urohyal (*Ur. h.*), basibranchial (*Bas. b.*), ceratobranchial (*Cer. b.*), and epibranchial (*Ep. b.*). The entglossum is entirely cartilaginous and is bifurcated in the posterior half, the forks articulating in each side with the basihyal. The osseous basihyal is a solid piece broadening posteriorly, reaching its greatest width where the basibranchials come off. It then narrows immediately into the urohyal which has the same structure except for the cartilaginous tip. The urohyal is about twice the length of the basihyal. The " horns " of the tongue bone are also of cartilage. The basal segments, the basi-branchials, are about one half the entire length of the horn ; the articulating joints, the ceratobranchials, are a little more than one fourth the length of the horn ; the last members, the epibranchials, are about one fourth the length of the horn.

The wide *pharynx* (*Pha.*, Pl. IV, Fig. 10) is succeeded by the œsophagus (*Œs.*, Fig. 10) which is immediately slightly dilated. There is no crop. Behind its anterior dilation the œsophagus gradually narrows until at its posterior end the diameter is little more than half the diameter of its anterior portion.

The *œsophagus* passes over into the proventriculus (*Prov.*, Pl. IV, Figs. 9, 10, 15), which opens into the anterior end of the gizzard (*Giz.*, Figs. 9, 10, 15) somewhat to the right of the midline. The gizzard is overlain anteriorly by the liver lobes, and extends posteriorly to the region of the cloaca.

The *intestine* (*Int.*, Pl. IV, Figs. 9, 15), arises from the right

side of the gizzard at the base of the proventriculus, and consists
of four distinct divisions :

1. The *duodenum* (*Duo.*, Figs. 6, 9, 15) makes up the entire
first loop.   It extends from the pylorus almost to the posterior end
of the stomach.   It then bends anteriorly, and at the edge of the
right liver lobe passes over into the small intestine.   The duodenum
is about 43 mm. in length.

2. The *small intestine* (Figs. 12, 15) lies between the duodenum
and the insertion of the cæca.   It measures about 85 mm.

3. The *terminal intestine* (Figs. 12, 15) extends from the in-
sertion of the cæca to the anus and is very short.   Anteriorly
the diameter is very small but posteriorly it is dilated at the cloaca.
Its length is about 18 mm.   Thus the entire length of the main in-
testine from pylorus to anus is 146 mm.   The intestine consists of
three closed loops of which the duodenal is the first in course.
The ascending branch of the third loop and the following portion
of the small intestine are covered by the first and second loops.
The descending branches of the second and third loops are to the
left of their respective ascending branches.   The intestinal ar-
rangement agrees with the iso-orthocœl type of intestine as defined
by Gadow (*l. c.*).

4. Two *cæca* (*Cæ.*, Figs. 12, 15) are present.   They are quiet
long and the terminal half of each almost equals the small intestine
in size.   At about one third the length of the cæca from their inser-
tion there is on each a constriction, and at this point the diameter
is less than in any part of the alimentary tract.   From tip to inser-
tion the cæca measure about 35 mm.

Filling the duodenal loop is a pale, slender organ, the *pancreas*
(*Pan.*, Figs. 6, 9, 15).   It consists of two branches, the main
branch occupying the position mentioned.   Extending beyond the
edge of the ascending branch of the duodenum is the smaller division.
The pancreas has two ducts (*Pan. d.*), both coming off on the dor-
sal surface.   The larger duct, which comes from the main portion,
arises proximal to the branching off of the smaller part, and run-
ning anteriorly close to the descending part of the loop of the duo-
denum enters its ascending branch just about where it begins to
curve along the right liver lobe.   The small duct comes from the
smaller division on its inner edge at a point about one third the
length of that division from its anterior end.

Only the merest rudiment of a spleen (*Spl.*, Pl. I, Fig. 9) is present.   It is a small, whitish, almost round body lying under the right lobe of the liver close beside the gall-bladder.

The *liver* (*Liv.*, Pl. IV, Figs. 9, 10, 15) consists of two smooth lobes, the right being somewhat the larger.   The lobes are connected anteriorly.   They extend from the heart back over the stomach for about one half its length.   From the right lobe just above the duodenum comes off the greenish colored gall-bladder (*G. bl.*, Fig. 9).   The figure exhibiting the pancreatic ducts shows also two others, one situated between the ducts of the pancreas and another anterior to the smaller pancreatic opening.   These I have taken to be the liver ducts (*Liv. d.*).   They could not be traced further on account of the mutilated condition of the bird.

The *salivary glands* were not found.

II. Respiratory Organs.

The *glottis* is an oval aperture situated behind the root of the tongue leading into the trachea.   Immediately posterior to the glottis is a bilobed fimbriated fold of the mucous membrane.

Ventrally, the *larynx* (*Lar.*, Pl. IV, Fig. 10) presents two rather flat, somewhat triangular, cartilages, the thyroids, which terminate anteriorly at the posterior border of the basihyal.   The thyroids are narrowed in front but not pointed.   The two cartilages are divided anteriorly by the urohyal which extends almost to their base.

The length of the *trachea* (*Tra.*, Pl. IV, Fig. 10) from the larynx to the branching of the bronchii is about 5 cm.   The rings of the trachea, about seventy-seven in number, are complete with two exceptions ; the anterior dorsal has its dorsal edges fused with the thyoid, and the rings of the posterior dorsal surface are incomplete.   There are three modifications of these rings on the ventral surface.   Succeeding the base of the larynx there are four simple rings.   The next three are slightly constricted in the middle. From this point down to where the trachea begins to broaden out before passing between the forks of the furcula, the rings are interlaced, trowel fashion.   Between the last of these rings and the branching of the bronchii we find a repetition of the condition first described, only the rings are broader and stronger.

The trachea has only two sets of muscles (Pl. IV, Figs. 7, 8, 10).

One pair comes off on each side from the last tracheal ring, and continues anteriorly almost to the larynx, at which point it spreads out fan-like, the delicate fibers being attached to the upper end of the windpipe ; this muscle is the *trachealis lateralis* (*Tr. Lat.*), named according to the description given by Shufeldt (1890),[1] though it does not agree in all points with it ; there is a partial agreement with Gadow's (*l. c.*) *m. tracheo-bronchialis.* The second pair of muscles is much stronger but shorter than the last described, and the origin is more ventral. They arise from the trachea on each side between the sixth and the tenth rings, counting forward from the last tracheal ring. The muscles become gradually smaller as they approach the insertion which is about the midpoint of the proximal part of the first rib articulating with the sternum. This is the *m. sterno-trachealis* (*St. tr.*), though it does not agree in all points with Gadow's (*l. c.*) description of the muscle of the same name.

The *syrinx* (Pl. IV, Figs. 7, 8) is tracheo-bronchial. On the ventral surface (Fig. 7) the last tracheal ring is directed downward forming with the one above an almost triangular space, of which the preceding tracheal ring is the base. Corresponding to the last tracheal ring on the left side there are two on the right, separated by a small space. These rings and the first bronchial rings are fused at their inner extremities to a small membrane at the base of which the bronchii separate. This membrane is stronger than that between the rings, and is of a yellowish color. The second bronchial ring bifurcates at its inner extremity, the lower branch fusing with the following ring, thus causing it to be much enlarged at its inner termination. Each bronchus is bounded on its inner surface by a cartilaginous rod, and this rod closes the almost circular space embraced partially by the above mentioned bifurcation. The second, third and fourth rings are larger than any of the others, less flexible, and of a yellowish color.

The *membrana tympaniformis externa* (*Tym. ex.*), is double in this bird. It is bounded by the second and fourth rings, and crossed in the middle by the third. This third ring is larger than the other two. The fourth at its inner extremity loses the yellowish color and for this reason seems shorter than it really is. In all, the number of rings in the right bronchus is fourteen and in the left twelve. This may be an individual variation.

[1] Myology of the Raven, Philadelphia, 1890.

On the dorsal surface (Fig. 8) we find a condition quite different from that shown on the ventral. All of the bronchial rings are incomplete dorsally. Counting forward from the last tracheal ring, we find between the third and sixth rings a cartilaginous bridge situated in the mid-line of the trachea. It is like the cartilage of the rings, and is, probably, a fusion of the dorsal ends of the fifth, fourth and part of the third rings with an extension to the sixth. This bridge broadens posteriorly, and at the third ring from the last divides, the branches terminating at the last tracheal ring. Down the center of the pyramidal-shaped area enclosed by this fork passes a yellowish rod which is quite resistant to the needle and is probably bony. It extends beyond the ends of the fork. This pyramidal area is bounded posteriorly by a cartilaginous ridge which bends back in the mid-line and gradually fades out on the side as the bronchial half-rings are reached, forming at this point the upper boundary of the *membrana tympaniformis interna* (*Tym. in.*). Below this is another ridge of like structure which forms the lower boundary of the inner tympaniformis.

Between the dorsal ends of the third, fourth, and fifth half rings there is a round whitish body covered irregularly with yellowish brown spots. About half way between the ends of the next four half rings there is, in the right tympaniformis, a white club-shaped body (Pl. I, Fig. 8, *x*). The membrane is much thinner around its edges than elsewhere. Strands of a dark pigment substance are seen around the edges and over the inner surface of this object when the bronchus is opened. A similar structure has evidently been lost from the left tympaniformis, judging from the appearance of the membrane. All of these bodies are probably bits of cartilage.

III. FEMALE UROGENITAL ORGANS (Pl. IV, Fig. 11).

The left ovary (*Ov.*) is situated anterior to the left kidney. The oviduct (*L. ovi*), a very much convoluted tube, terminates anteriorly in an *infundibulum* (*Inf.*) facing the left ovary. It lies to the left of the pelvic cavity and opens posteriorly into the left side of the cloaca just behind the ureter. The right ovary is absent, but a very much reduced oviduct (*R. ovi.*) is present. The infundibulum is readily made out, and slight convolutions of the duct are to be observed.

The fused *kidneys* (*K.*) extend from the lungs to the pelvic cavity. The right kidney, slightly larger than the left, consists of three lobes, the middle one being the smallest. The two lobes of the left kidney are of about equal size. The *ureters* (*Ur.*) pass posteriorly to the cloaca which they enter on its dorsal surface median to the oviducts.

IV. Central Nervous System (Pl. I, Figs. 2, 3 ; Pl. II, Fig. 16*a*).

The brain of this bird is notably small as compared with the size of the head. Its length much exceeds its breadth, resembling in this respect the brain of a lizard. The large optic lobes (*Op. l.*) are only partially covered by the cerebral hemispheres. The cerebellum (*Cb.*), which is comparatively large, covers the medulla oblongata (*Med.*) and on each side of it a flocculus (*Flo.*) is found. The greatest length of the cerebrum (*Cere.*) is about 8 mm., its width 9.5 mm. The longest measurement of the cerebellum is approximately 6 mm., its breadth above the flocculi 5 mm. The uncovered portion of the optic lobes measures from dorsal to ventral surface about 5.5 mm., anterior to posterior border 3 mm. No drawings or measurements of the ventral surface of the brain could be made on account of its torn condition.

The *spinal cord* (*Sp.*), is marked by two important swellings ; one in the cervical region known as the *brachial plexus* (*Br. u.*) (Pl. II, Fig. 16*a*), and one in the posterior region as the *sacral plexus*. Anterior to the brachial plexus the cord is larger than it is between this plexus and the succeeding one. The swelling which indicates the branchial plexus begins at the tenth nerve and terminates with the thirteenth. Three nerves take part in the formation of this plexus, the eleventh, twelfth and thirteenth. The second or middle nerve is the largest of the three, the third the smallest. Soon after leaving the cord the second nerve bifurcates, one branch going to each of the other two and all intimately related. The posterior part of the spinal cord was too badly broken for the nerves of that region to be made out.

V. Sense Organs (Pl. IV, Figs. 2, 4, 5).

The *nostrils* (*Nos.*) are tubular and cylindrical, opening forward and outward. Vibrissæ, very much shorter and more delicate than those around the gape, are observed about the nostrils. These

are arranged in a somewhat circular fashion just posterior to the external opening. On each side of the median ridge of the palate is a long, narrow slit bounded by fimbriated folds of mucous membrane, the internal nares.

The pecten of the eye (Figs. 4, 5) consists of four folds. It measures in height about 2 mm., and its basal breadth is about 1.5 mm. Like the choroid coat it is heavily pigmented.

VI. Myology.

Only muscles of the extremities have been considered, and in naming them the terminology of Gadow (*l. c.*) has been followed as strictly as possible. There are, however, many deviations from his definitions.

1. *Anterior Extremity.*

Here are described all the muscles of the wing proper, also all coming from the shoulder girdle, ribs and vertebræ and inserting upon the wing, also all the muscles inserting on the scapula and coracoid. The metacarpals named by Gadow (*l. c.*) I, II and III are herein termed II, III and IV, for recent embryological investigation show the first and fifth to be the ones lost.

A. *Pectoral Muscles.*

1. *M. pectoralis.* The *pars propatagialis* and *pars abdominalis* are absent.

Pars thoracica (*Pect.*, Pl. V, Fig. 24; Pl. VI, Fig. 25). This is the large superficial muscle of the breast, and covers the other breast muscles. It has an extensive origin, coming from the clavicle and the membrane between that bone and the sternum; from the surface of the keel, the upper half; the posterior border of the sternum; and the posterior lateral portion of the breast bone.

It has two points of insertion, both of which are on the humerus. The short strong tendon which terminates on the ventral projection of the humerus, just anterior to the biceps, is the posterior insertion. The fibers of the anterior portion converge and pass obliquely to the dorsal crest of the humerus and are there attached fleshily.

2. *M. supracoracoideus* (*Sup. cor.*, Pl. VI, Figs. 25, 30). This is a double-feathered muscle arising from that portion of the coracoclavicular membrane not occupied by the muscle just described,

from about the lower half of the keel and from that portion of the
body of the sternum not appropriated by the above muscle.   The
fibers converge to a line which is dorsal to the mid-line, passing
over into a strong flat tendon that bends around to the inner sur-
face of the coracoid.   The tendon goes through the foramen trios-
seum and is attached to the humerus on its dorsal projection.

3. *Coraco-brachialis posterior* (*Cor. br. p.*, Pl. VI, Figs. 25, 26,
30).   When the *m. pectoralis* is turned back this small muscle is
seen extending out from under the supracoracoideus.   It arises
from the dorsal proximal half of the border of the coracoid.   The
fibers converge to form a short strong tendon which is attached to
the antero-ventral margin of the humerus just anterior to the
pneumatic foramen.

B. *Other trunk muscles inserting on wing, scapula and coracoid.*

1. *M. deltoideus major* (Pl. V, Figs. 16, 22).   This muscle
consists of an anterior and posterior portion.   The delicate an-
terior part (*Del. a.*) arises fleshily from the inner surface of the
clavicle and the neighboring portions of the scapula.   It emerges
from the foramen triosseum, crosses the tendon of the *m. supracor-
acoideus*, runs entirely around the projection to which the tendon
of the muscle is attached, and makes a fleshy insertion at the base of
the anterior border of the humeral crest.

The large posterior portion (*Del. p.*) springs from the dorsal
border of the clavicle and adjoining dorsal surface of the scapula.
It passes obliquely downward and is inserted fleshily on the humeral
crest and along the shaft of the humerus for about one half its
length.   This differs somewhat from Gadow's description.

2. *M. deltoideus minor.*   This muscle could not be made out,
therefore is probably absent.

3. *M. latissimus dorsi* (Pl. V, Figs. 17, 22 ; Pl. VI, Fig. 26).
This is the most superficial muscle of the back, and is revealed by
the removal of the skin.   It consists of two portions, a very thin
anterior layer and a much larger and stronger posterior muscle
bundle.

The anterior portion (*Lat. d. a.*) arises from the spine of the
last cervical vertebra and from the spines of the two following
dorsal vertebræ.   The fibers pass in a transverse direction over the
scapula, converging somewhat after crossing it, and diverge as they

approach the humerus. The muscle inserts upon the humerus between the pars scapuli-cubitalis and the pars humero-cubitalis near the lower point of the humeral crest.

The posterior part (*Lat. d. p.*) comes from the last dorsal vertebra and the anterior rim of the ilium. The fibers converge rapidly as they pass anteriorly, and find their insertion on the humerus beneath the anterior border of the above.

4. *M. rhomboideus superficialis* (*Rh. s.*, Pl. V, Figs. 17, 22). This flat muscle comes from the last two cervical vertebræ and the following dorsal vertebræ. It is inserted fleshily on the dorsal part of the furcula and on the entire dorsal border of the scapula.

5. *M. rhomboideus profundus* (*Rh. p.*, Pl. IV, Fig. 17). This muscle is covered by the last mentioned muscle and by the posterior portion of the latissimus dorsi. It springs fleshily from the last cervical and first dorsal vertebræ. The outward directed fibers find a fleshy insertion on the posterior half of the dorso-median border of the scapula, the insertion being continued down to the posterior tip of this bone.

6. *M. scapuli-humeralis anterior.* This muscle is absent.

7. *M. scapuli-humeralis posterior* (*Sc. hum. p.*, Pl. V, Figs. 17, 22; Pl. III, Fig. 26). This large, somewhat rhomboidal-shaped muscle comes from the outer surface of the posterior two thirds of the scapula. It is covered by both portions of the latissimus dorsi. Its fibers are directed forward and downward, converging rapidly to form a small, round bundle which is attached within the foramen pneumaticum.

8. *M. subscapularis* (*S. sc.*, Pl. VI, Fig. 26). This muscle becomes visible after the removal of the m. scapuli-humeralis posterior and m. scapuli-cubitalis. Anteriorly it comes from the dorsal surface of the scapula just posterior to the origin of the scapuli-cubitalis, and posteriorly from the lower border of the same bone where it is overlain by the scapuli-humeralis posterior. In its middle portion it is divided into two parts by the anterior m. serratus superficialis, the inner division, subscapularis internus, coming from the ventral surface of the scapula. The outer portion is the subscapularis externus.

9. *M. serratus superficialis* (Pl. VI, Fig. 26) is made up of two parts. The smaller anterior division (*Ser. s. a.*) comes from the last cervical rib and its process uncinatus. The fibers are directed upward

and forward. The muscle terminates tendinously on the ventral border of the scapula. It divides the subscapularis.

The large posterior division (*Ser. sp.*) springs with four scallops or teeth form the second and third dorsal ribs, just below the processes of these ribs. The fibers of these closely-related bundles are directed upward and forward. The most posterior bundle is inserted on the posterior tip of the scapula. The others do not reach the scapula but terminate on the ribs and the membrane connecting them in this region.

10. *M. serratus profundus* (*Ser. p.*, Pl. VI, Fig. 26), occupies a more dorsal position than the last mentioned muscle, and is exposed by the removal of the m. scapuli-humeralis posterior. The edges of the two thin portions composing it overlap. The dorsal bundle comes from the free cervical rib at the outer end of the vertebral projection. The lower bundle arises from the last cervical rib and from the membrane connecting this and the preceding rib. Both bundles are inserted on the posterior median border of the scapula.

11. *M. sterno-coracoideus* (*St. co.*, Pl. VI, Fig. 26) is covered at its origin by the abdominal muscles. It arises tendinously from the first, second and third sternal ribs. This small muscle passes obliquely to the lateral projection of the sternum below the coracoid.

12. *M. subcoracoideus* (*Sub. co.*, Pl. VI, Fig. 26). This delicate fusiform muscle is revealed by the separation of the scapula and coracoid. It springs tendinously from the inner anterior border of the coracoid about one third the length of that bone from its distal end. It is inserted on the humerus proximal to the coracobrachialis posterior. The fibers of this muscle are closely associated with those of the subscapularis. It differs considerably from Gadow's description.

C. *Muscles restricted to the wing.*

1. *M. propatagialis, pars propatagialis musculi deltoidei* (*Pro.*). This includes both the long and short tendons, the other parts being absent. It arises fleshily from the dorsal end of the clavicle and from the neighboring portions of both coracoid and scapula. It is a flat muscle, about 14 mm. long and 5 mm. broad. At its distal end it tapers off into two tendons, the upper and more deli-

cate being the m. propatagialis longus the lower and stronger m. propatagialis brevis.

a. M. propatagialis longus (*P. pat. l.*, Pl. V, Figs. 22, 24). The tendon of this muscle runs along the anterior margin of the patagium, with which membrane it is intimately connected. Thence it continues as a very delicate tendon to the distal end of the radius. It becomes flattened as it passes over the os radiale, and continues so to its insertion. The flattened tendon passes to the ventral side of the os magnum along its base, and is inserted on the posterior proximal projection of the pollex digit. From this point a pyramidal-shaped tendon with its apex on the pollex-digit extends down to the third metacarpal.

b. M. propatagialis brevis (*P. pat. b.*, Pl. V, Figs. 22, 23) is very complex in this bird. The tendon is larger than the longus and flattened. It continues distally to the m. extensor metacarpi ulnaris (radialis?) where it bifurcates, about 5 mm. from the distal end of the humerus. The longer branch runs back with the m. extensor metacarpi ulnaris (radialis?) to become inserted on the humerus just distal to this muscle, and at the base of the tubercle of the external condyle of the humerus. The shorter one continues distally about 2 mm., then passes back obliquely to the m. extensor digitorum communis and here it bifurcates, the proximal short branch running back with the above muscle to insert itself on the tubercle above the external condyle of the humerus and above the origin of the m. ectepicondylo-radialis. The distal extending branch becomes flattened at its insertion, which is at the base of the styloid process of the radius on its ulnar side, near the m. extensor pollicis longus and covered by it. From the second bifurcation comes off a broad band which passes directly across to the ulna and is inserted on that bone about 7 mm. or 8 mm. from its proximal end.

2. The *metapatagium* was torn away, so I can say nothing about the *m. metapatagialis*.

3. *M. biceps brachii, pars propatagialis* (*Bi.*, Pl. VI, Figs. 20, 27; Pl. II, Fig. 24). This large muscle lies on the anterior surface of the forearm, and arises as two heads. The long head comes from the anterior end of the coracoid as a strong, flat tendon. The short head passes immediately into a stout muscle. The two posteriorly unite to form a fusiform muscle which inserts at the elbow

joint, the more delicate portion of the split tendon being attached to the radius on its inner surface, the other portion to the ulna at the base of the m. flexor digitorum profundus and dorsal to the m. brachialis inferior.

4. *M. brachialis inferior* (*Br. inf.*, Pl. V, Fig. 24). This trapezoid-shaped muscle arises fleshily from the distal end of the humerus, and from its inner surface interior to the origin of the m. extensor metacarpi ulnaris (radialis?). It crosses to the ulna and is inserted on that bone beyond the elbow joint and between the separated portions of the m. flexor digitorum profundus.

5. *M. triceps cubiti.* This muscle consists of two parts, one long head and two short ones.

a. Pars scapuli-cubitalis (*Pars. sc. cub.*, Pl. V, Figs. 16, 17, 22; Pl. III, Fig. 29). This one arises from the neck of the scapula, posterior to the scapular projection which forms part of the glenoid fossa. It passes obliquely across the humerus above the insertion of the latissimus dorsi, continues down the dorsal posterior side of the humerus and near its distal end comes off in a strong flat tendon which is inserted on the rim of the dorsal proximal process of the ulna.

b. Pars humero-cubitalis (*Pars. hu. cub.*, Pl. V, Fig. 24; Pl. IV, Fig. 28) arises by two heads, the inner comes from within the rim of the humeral head, while the stronger has its origin on the outer aspect of the head of the humerus, and from about its proximal quarter. This part ends in a tendon and a broad aponeurosis inserted on the proximal edge of the olecranon process of the ulna, and the intervening space between this process and the insertion of the scapuli cubitalis.

6. *Mm. entepicondylo-antibrachiales.*

a. Mm. entepicondylo-radiales.

(1) *Pronator sublimis* (*Pron. s.*, Pl. V, Fig. 24). This is the most superficial muscle of the inner arm. It springs tendinously from above the internal condyle of the humerus, and interior to the origin of the brachialis inferior. It passes obliquely across the interosseus space to become inserted on the ventral side of the radius for about one third its proximal length.

(2) *Pronator profundus.* This muscle is smaller than the sublimis, and is covered for nearly its entire length by the superficial muscles. It arises from the lower edge of the internal condyle of the

humerus, and is almost concealed at its origin by the strong tendons of the flexor digitorum sublimis.   It is split in two by the extensor indicis longus.   The fibers of the upper half pass obliquely over to the radius and are inserted on that bone under the pronator sublimis, extending about as far distally as that muscle.   The lower half bends under the m. extensor indicis longus and is inserted on the radius in a position corresponding to the upper half.   This muscle is not shown in the drawings.

b. M. entepicondylo-ulnaris is absent in this bird.

7. *M. ectepicondylo-ulnaris* (*Ect. u.*, Pl. V, Fig. 19) arises by a strong tendon from the posterior projection of the external condyle of the humerus below the m. extensor digitorum communis, and is covered by the tendon of the m. extensor carpi-ulnaris (radialis?). It passes over to the anterior surface of the ulna, and is there inserted fleshily for fully two thirds the length of that bone.

8. *M. ectepicondylo-radialis* (*Ect. r.*, Pl. V, Fig. 19).   This muscle arises from the posterior projection of the external condyle of the humerus, below the origin of the m. extensor digitorum communis and below the insertion of the second forward directed branch of the m. propatagialis brevis.   It passes directly over to the proximal end of the radius and is inserted fleshily along its dorsal surface for about one third its length.

9. *M. flexor carpi ulnaris* (*F. carp. ul.*, Pl. V, Fig. 24).   This is the largest muscle of the forearm.   It arises by a strong, flat tendon from the posterior border of the external condyle of the humerus.   It is held in place by a ligament which passes from the condyle over and under the tendon to the base of the olecranon process of the ulna, thus forming a loop.   The muscle runs along the ventral surface of the ulna and at about the middle of that bone separates into two tendons.   Both continue distally to become inserted on the outer border of the os ulnare, the more delicate on the lower edge.

10. *M. ulni metacarpalis ventralis* (*Ul. met. v.*, Pl. V, Fig. 24). This muscle arises fleshily from about the middle three fifths of the ventral and posterior surface of the ulna, and is broadest at the distal end immediately before passing over into the tendon which crosses in front of the os radiale, to the surface of the third metacarpal and is inserted on its dorsal proximal projection.   It is covered by the tendons of other muscles which find their insertion in

this region.   The distal portion of this tendon with that of the m. flexor digitorum is held in place by a delicate ligament extending from the distant ventral border of the radius to the ventral projection on the third metacarpal above the os carpi ulnare.

11. *M. ulni metacarpalis dorsalis* (*Ul. met. d.*, Pl. V, Fig. 24), arises by a short strong tendon from the dorsal distal end of the ulna at the base of the external condyle.   The tendon bends around the condyle to its posterior border where it swells rapidly into a thick muscle.   The greater part of the muscle is inserted fleshily on the posterior border of the fourth metacarpal.   A small part of the muscle terminates distally in a broad, flat tendon which fuses with those that go to the quills.

12. *M. extensor metacarpi ulnaris* (*radialis ?*) (*E. met. ul. r.*, Pl. V, Figs. 19, 20, 22, 24).   The origin of this muscle is the most proximal of all that come from the distal end of the humerus.   It arises by two heads, one tendinous, the other fleshy, from the anterior surface of the humerus superior to the external condyle and above the upper insertion of the m. propatagialis brevis, the tendinous head being somewhat dorsal.   At about 7 mm. from its origin the tendon passes over into a fusiform muscle.   At the same point is given off a tendinous sheath which fuses with the tendon of the propatagialis brevis, above the first bifurcation of that tendon.   This muscle is smaller and lies dorsal to the one of fleshy origin.   About the mid-point of the radius the two muscles unite to form a strong, flat tendon which passes over the end of the radius, across the os radiale, and is inserted on the apex of the os magnum.

13. *M. extensor metacarpi ulnaris* (*E. met. ul.*, Pl. V, Fig. 22). This muscle springs from the external condyle of the humerus close beside the m. extensor digitorum communis.   At its origin it is held in place by a delicate ligament.   It finds attachment on the posterior surface of the third metacarpal about one third the distance from its proximal end.

14. *M. flexor digitorum sublimis* (*F. dig. s.*, Pl. V, Fig. 24). This is the central superficial muscle of the inner forearm.   It arises by a strong, flat tendon from the internal condyle of the humerus.   The muscle bundle runs parallel to the ulna, and on the inner side of the flexor carpi ulnaris for about two thirds the length of the ulna, and there separates into two tendons.   The posterior tendon passes over the os ulnare, bends under the tendon of the m.

extensor digitorum profundus to the antero-ventral surface of the
third metacarpal, runs along the anterior rim of the first phalanx of
third digit, and is inserted on the proximal end of the second pha-
lanx about one third its length from the proximal end.   The ante-
rior tendon continues to the wrist where it merges into a tendin-
ous band which extends from the ventral edge of the styloid proc-
ess of the radius to the anterior border of the os ulnare.   From
this latter point come off two other tendons, the upper and more
delicate being inserted at about the mid-point on the ventral bor-
der of the third metacarpal.   The thin, flat, posterior tendon runs
along the ventral surface of the fourth metacarpal and is attached
near its distal end.   The insertion is quite different from the de-
scription of Gadow (*l. c.*).

15. *M. flexor digitorum profundus* (*F. dig. p.*, Pl. V, Fig. 24).
This muscle arises fleshily from the proximal half of the ventral sur-
face of the ulna.   Proximally it is divided into two almost equal
portions by the brachialis inferior which inserts on the ulna between
them.   The surface of origin gradually diminishes and ceases alto-
gether when the broad expansion of the ulni metacarpalis ventralis
is reached.   At the wrist the tendon runs under the tendinous
band of the m. flexor digitorum sublimis, passes above the ventral
projection on the proximal end of the third metacarpal, and is here
held in place by a ligament extending from this projection to the
distal ventral edge of the radius.   It is inserted on the antero-
ventral rim of the proximal end of the second phalanx of the third
digit.

16. *M. extensor digitorum communis* (*Ex. dig. c.*, Pl. V, Fig.
22).   This fusiform muscle arises by a short tendon from the ex-
ternal condyle of the humerus between the tendons of origin of the
m. extensor metacarpi ulnaris and m. ectepicondylo radialis.   The
muscle becomes tendinous at about two thirds the length of the
radius.   Soon after passing the ulna the tendon bifurcates, sending
a delicate slip to the pollex digit, inserting about one third the
length of that bone from its proximal end.   The long fork is twice
crossed by the tendon of the m. extensor indicis longus and is finally
inserted on the proximal rim of the first phalanx of the third digit.

17. *M. extensor pollicis longus* (*E. pl. l.*, Pl. V, Figs. 19, 22).
Covered by the *m. extensor indicis longus*, the muscle comes from the
facing surfaces of ulna and radius, from the proximal third of the

ulna and about the middle third of the radius. At its proximal
extremity it is crossed by a ligamentous band passing from ulna to
radius. It is also held close to the radius by fascia. The tendon
accompanies the m. extensor metacarpi ulnaris (radialis?) to the
apex of the os magnum and is there attached below that muscle.

18. *M. extensor indicis longus* (*E. ind. l.*, Pl. V, Figs. 22, 24).
This muscle arises by a very short tendon from the internal condyle
of the humerus. It passes directly to the ventral surface of the
radius, and is attached fleshily to the ulna facing surface of that
bone for fully five sixths of its length. The tendon bends under
the radius and becomes dorsal. It crosses the tendon of the m.
extensor digiterum communis, and finds attachment on the base
of the second phalanx of the third digit. It fails to agree with
Gadow's diagnosis.

19. *M. interosseus dorsalis* (*Int. d.*, Pl. V, Fig. 21). Both
interossei spring from the facing surfaces of the third and fourth
metacarpals. In this description the name dorsalis is given to that
muscle which clings to the third metacarpal. At the distal end of
the interosseous space the muscle becomes tendinous and bends
posteriorly, passing along the dorsal surface of the phalanx of the
fourth metacarpal, then to the ventral distal end of the second
phalanx of third digit to become inserted about four fifths the
length of that bone from the proximal end.

20. *M. interosseus palmaris* (*Int. p.*, Pl. V, Fig. 21). This
muscle comes from the anterior surface of the fourth metacarpal,
and terminates tendinously about one half the length of that bone.
The tendon turns dorsally, and is attached to the distal end of the
first phalanx of the third digit on its dorsal surface.

21. *M. abductor indicis* (*Ab. in.*, Pl. V, Fig. 20). This muscle
springs fleshily from the ventral surface of the proximal two thirds
of the third metacarpal, its proximal end being at the base of the
ventral projection of that metacarpal. The round, strong tendon
is inserted on the proximal anterior rim of the second phalanx of
digit three.

22. *M. flexor pollicis* (*Fl. pl.*, Pl. V, Fig. 20). This short
muscle comes from the proximal ventral surface of the third meta-
carpal, lying between the abductor pollicis and the ventral pro-
jection of this metacarpal. It terminates on the posterior proximal
projection of the pollex digit.

23. *M. abductor pollicis* (*Ab. pl.*, Pl. V, Figs. 20, 24). This rather round muscle arises tendinously from the lower surface of the tendon of the m. extensor metacarpi ulnaris (radialis?) somewhat proximal to its point of insertion. The muscle then twists around the base of the pollex digit to its ventral surface, and terminates tendinously about its mid-point.

24. *M. extensor pollicis brevis* is not present.

25. *M. adductor pollicis* (*Ad. pl.*, Pl. V, Figs. 20, 24). This fairly well developed muscle lies between the posterior surface of the pollex digit and the anterior surface of the third metacarpal. It arises by a strong, fleshy base from the proximal eighth of the third metacarpal, thence it goes obliquely to the pollex digit and is attached by a delicate tendon about one third the length of the digit from its distal end.

26. *M. flexor digiti III* (*F. dig. III*, Pl. V, Figs. 20, 24). This slender muscle has its origin on the posterior proximal third of the fourth metacarpal. At its fleshy base is a broad ligament extending from the anterior rim of the os ulnare to this point. Near the distal end of this metacarpal the muscle becomes tendinous and finds attachment about the mid-point of the first phalanx of fourth digit.

Below are given some muscles found on this bird and not mentioned by Gadow (*l. c.*).

A. (*A.*, Pl. V, Fig. 21.) This is a very delicate muscle extending along the dorsal surface of the third metacarpal, and at its origin is covered by tendons of other muscles, fascia and surrounding membranes. It arises by a delicate tendon from the distal dorsal edge of the radius. The round fusiform carneous portion is covered by the tendons of the extensor digitorum communis and extensor indicis longus. Its distal hair-like tendon fuses with the m. extensor indicis longus at a point opposite the middle of the third metacarpal.

B. (*B.*, Pl. V, Fig. 24.) This slender muscle extends from the distal end of the first phalanx of the third digit to the distal end on the dorsal side of last phalanx of that digit.

C. From the dorsal distal end of the ulna a tendon passes to the quills. It is not shown in the figures.

D. (*D.*, Pl. V, Fig. 21.) This is a flat muscle which has its carneous origin on the proximal dorsal surface of the third metacarpal. It lies between the proximal projection of .that bone and the

pollex digit and os magnum.   It is inserted tendinously on the proximal ridge of the pollex digit.

E. This is a short, stout muscle arising from the ventral and dorsal end of the coracoid.   It passes directly over to the head of the humerus where it is inserted, one point of the insertion extending down to the anterior border of the humeral crest.   The long tendon of the biceps passes over this muscle, which does not appear on the plates.

2. *Posterior extremity.*

Here are described only those muscles that insert upon and arise from the femur.   The hind limb is so weak in this species and its other muscles so delicate, that it did not seem worth the time to work out its whole musculature.   They are described in the order of their occurrence, beginning with the superficial.

1. *M. ilio-tibialis internus or Sartorius* (*Il. tib. int.*, Pl. VI, Figs. 31, 34, 35).   This is the most anterior muscle of the thigh, of those extending from pelvis to femur.   It comes fleshily from the dorso-lateral border of the ilium and covers the posterior origin of the posterior portion of the latissimus dorsi, and the anterior edge of the ilio-trochanterici.   It runs free from the muscles of the pelvis behind it to the femur, gradually diminishing in size and terminating in a flat tendon on the inner surface of the knee joint where it is covered by a lower leg muscle.

2. *M. ilio-trochanterici* (*Il. troch.*, Pl. VI, Figs. 31, 35). This large, somewhat pyramidal-shaped muscle arises fleshily from the region of the acetabulum and that portion of the preacetabular ilium not occupied by the sartorius, the fibers extending even to its ventral border.   These converge and insert by a thin tendon on the trochanter where it is covered by the m. ilio-tibialis.   It has not the divisions given by Gadow (*l. c.*), but is a compact muscle.

3. *M. ilio-tibialis* (Pl. VI, Figs. 31, 34, 35).   This thin, broad muscle is the most superficial one of the thigh.   It springs semitendinously from the acetabular and post-acetabular ilium.   It consists of an anterior and posterior portion which are readily distinguished.   The anterior portion (*Il. tib. ant.*) extends about two thirds the length of the femur, then merges with the underlying muscle.   The posterior portion (*Il. tib. post.*) diminishes in width distally and inserts aponeurotically upon the muscles covering the outer surface of the knee joint.

4. *M. caud-ilio-flexorius* (*Caud. il. flx.*, Pl. VI, Figs. 31, 32, 33, 34, 35). Behind the last mentioned muscle this superficial one is found. It is a small band-shaped muscle, coming from the posterior border of the ischium. It is partially covered on its anterior margin by the m. ilio-tibialis and m. ilio-fibularis. The termination is very peculiar. Coming from the under, distal surface of the femur is a short, broad muscle, which fuses with the large muscle mass, the line of fusion being almost at right angles to the fibers of that portion. From its tibial side comes off a short muscle bundle with fibers directed downward and the tendon of which fuses with that of one of the leg muscles. This shows great deviation from Gadow's (*l. c.*) description.

5. *M. ischio-flexorius* (*Isc. flx.*, Pl. VI, Figs. 31, 33, 34, 35). This narrow muscle band comes from the distal border of the ischium at its union with the pubis. It is covered anteriorly by the last mentioned layer. Its thin, flat tendon finds insertion on the anterior borders of the tibial neck.

6. *M. ilio-fibularis* (*Il. fib.*, Pl. VI, Figs. 31, 34, 35). This layer becomes visible after the removal of the m. tibialis anterior and posterior. It springs from the acetabular ilium. It ends in a small, round tendon, which, passing through a tendonous loop at the knee, continues down the leg to become inserted between fibula and tibia at the point where the former becomes free from the latter.

7. *M. femori-tibialis* (*Fm. tib.*, Pl. VI, Figs. 33, 34, 35). This is the largest of the thigh muscles. It is partially covered on the ventral anterior border by the m. ilio-tibialis internus, dorsally by the m. ilio-tibialis anterior. Its origin begins at the trochanter and it is attached fleshily to the femur on both dorsal and ventral surfaces. It finds a tendinous insertion at the knee joint, being attached to the proximal border of the tibia. The separation into parts as given by Gadow (*l. c.*) can not be made out.

8. *M. caud.-ilio-femoralis* (*Caud. il. fm.*, Pl. VI, Fig. 35). This is revealed by the removal of the m. ilio-fibularis and m. caud-ilio-flexorius. Its width where it passes under the m. caud-ilio-flexorius is equal to that of the above muscle. It comes as a small rounded tendon from the ventral lateral border of the pygostyle. Just before reaching the ischium the tendon passes over into the fleshy muscle. This bends around in a semicircular fashion to the proximal

third of the femur, and here finds a fleshy insertion on the linea as-
pera, occupying its posterior surface.   Pars iliaca is absent and pars
caudalis does not agree in origin with Gadow's (*l. c.*) description.

9. *M. ischio-femoralis* (*Isc. fm.*, Pl. VI, Fig. 35).   This
muscle is proximal to the above.   It springs from joining surfaces
of ischium and ilium and from neighboring surface of ischium down
to the origin of the m. pub.-ischo-femoralis.   This short, thick, flat
muscle there crosses the femur and is inserted by a small, thin
tendon at the base of the trochanter.

10. *M. pub-ischio-femoralis* (*Pb. isc. fm.*, Pl. VI, Figs. 33, 35).
This is one of the largest muscles of the thigh.   It arises from the
proximal half of the pubis and ischium along their line of union.
It passes somewhat obliquely over to the distal half of the femur
and is there inserted fleshily by its anterior border.   Its fibers are
intimately associated with those of the m. caud-ilio-flexorius.   It
consists of only one portion, a thick, flat layer.

11. *M. obturator* (*Obt.*, Pl. VI, Fig. 35).   This is the deepest
lying of the muscles of the outer surface.   It springs fleshily from
the edges of the foramen obturatum.   Thence it passes to the poste-
rior border of femur, and there is attached semitendinously.   The
muscle varies considerably from that of Gadow's (*l. c.*) of the
same name.   It agrees in some points with his mm. accessorii m.
obturatoris.

12. *M. ilio-femoralis internus* (*Il. fm. int.*, Pl. VI, Fig. 33).
This somewhat triangular muscle comes from the ventral surface,
near its lateral border, of the preacetabular ilium extending almost
to the acetabulum.   It passes to the ventral surface of the femur
just distal to the head, and is there attached.   The muscle is fleshy
both at origin and insertion.

13. *X.* (Pl. VI., Fig. 33).   This is a long slender muscle begin-
ning distal to the insertion of the m. ilio-femoralis internus, and is
attached fleshily to the ventral surface of the femur for its remain-
ing length.   It terminates distally in a thin, flat tendon which is
inserted on the dorso-ventral border of the proximal end of the
tibia.   Gadow (*l. c.*) did not describe such a muscle.

The following muscles were not found : *m. ilio-femoralis exter-
nus, m. ambiens, mm. accesorii m. obturatoris.*

VII. Comparisons.

Certain characters of the better known genera of the Caprimulgidæ are compared in the following table:

	Carotids.	Cæca.	Oil Gland.	Biceps Slip.	Gall Bladder.	Glutæus.	Thigh Muscles.	Sternum.	Syrinx.	Last Toe with Four Phalanges	Middle Toe Serrated.	Powder Downs.
Caprimulgus.	2	x	x	x	x	Over biceps.	Axy	One notch.	Traches-bronchial.	x	x	—
Nyctidromus.	2	x	x	x	x	"	Axy	"	"	x	x	—
Chordeiles.	2	x	x	x	—	"	Axy	"	"	x	x	—
Antrostomus.	2	x	x	x	x	"	Axy	"	"	x	x	—
Phalænoptilus.	2	x	x	—	x	"	(A)y	"	"	x	x	—

The sign "x" denotes occurrence, and "—" absence of a character. The formulæ for the thigh muscles are those given by Garrod (1874), slightly modified by Gadow (1891), and denote the presence of the following muscles:

Pars caudalis m. caud.-il. femoris.. = A
Pars iliaca m. caud.-il. femoris................ .... = B
M. caud-il. flex. inserting only on the tibia........................ = X
M. caud-il. flex. with the "accessorius" inserting on the
    femur .... = Y

All the points of comparison of the first four genera in the above table were taken from Beddard (1898). It will be noticed that the amount of difference in these forms is slight. The only characters which differ are the gall bladder, absent in *Chordeiles*, biceps slip, absent in *Phalænoptilus*, and the difference in the last genus of the muscle formula for the thigh.

So far as the tabulated characters are concerned, *Phalænoptilus* appears less closely related to *Chordeiles* than to the other genera. In two of its muscle characters it differs from all the other genera.

VIII. Aberrant Characters.

In closing it will be well to call attention to the striking variations from the muscles of the birds studied and described by Gadow (*l. c.*).

The following wing muscles were not found: Biceps slip, m. extensor policis brevis, m. entepicondylo-ulnaris and m. deltoideus minor. Some not mentioned by him were present in the

bird, and in the descriptions and drawings are denoted by the leters A, B, C, D, and E. The complex arrangement of the m. propatagialis brevis should also be mentioned.

Of the thigh muscles these were missing : m. ilio-femoralis externus, m. ambiens, and mm. accessorii m. obturatoris. A muscle herein denoted by the letter X was not given by Gadow. Pars caudalis m. caud-ilio-femoralis differs from Gadow's description and this difference is indicated in the table by placing the letter representing it in parenthesis. M. caud-ilio-flexorius showed considerable variation.

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DESCRIPTION OF THE PLATES.

The following abbreviations have been employed :

Ab. in., Musculus abductor indicis.

Ab. pl., M. abductor pollicis.

Ad. pl., M. adductor pollicis.

A., Anus.

Bas. h., Basihyal.

Bas. b., Basibranchial.

Bi., Biceps brachii, pars propatagialis.

Bi. T., Tendon of biceps brachii.

Bi. inf., Musculus brachialis inferior.

Br. n., Brachial nerve.

Bro., Bronchus.

C., Coracoid.

Cæ., Cæca.

Caud. il. flx., Musculus caud.-ilio-flexorius.

Caud. il. fm., M. caud.-ilio femoralis.

Cb., Cerebellum.

Cer., Cerebrum.

Cer. b., Cerato-brachial.

Cl., Clavicle.

Clo., Cloaca.

Cor. br. p., Musculus coraco-brachialis posterior.

Del. a., M. deltoideus major anterior.

Del. p., M. deltoideus major posterior.

Duo., Duodenum.

Ect. r., Musculus ectepicondylo-radialis.

Ect. u., M. ectepicondylo-ulnaris.

E. dig. c., M. extensor digitorum communis.

E. dig. c. t., Tendon of m. extensor digitorum communis.

E. ind. l., Musculus extensor indicis longus.

E. ind. l. t., Tendon of M. extensor indicis longus.

E. met. ul., Musculus extensor metacarpi ulnaris.

E. met. ul. r., M. extensor metacarpi ulnaris (radialis?).

E. met. ul. r. t., Tendon of m. extensor metacarpi ulnaris (radialis?).

Ent. g., Os entglossum.

E. pl. l., Musculus extensor pollicis longus.

Ep. b., Epi-branchial.

F. carp. ul., Musculus flexor carpi ulnaris.

F. dig. p., M. flexor digitorum profundus.

F. dig. s., M. flexor digitorum sublimis.

F. dig. III., M. digiti III.

Fl. pl., M. flexor pollicis.

Flo., Flocculus.

Fm. tib., M. femori-tibialis.

G. bl., Gall bladder.

Giz., Gizzard.

Ht., Heart.

Hu., Humerus.

Il. fib., Musculus ilio-fibularis.

Il. fm. int., M. ilio-femoralis internus.

Il. tib. ant., M. ilio-tibialis anterior.

Il. tib. post., M. ilio-tibialis posterior.

Il. tib. int., M. ilio-tibialis internus.

Il. troch., M. ilio-trochanterici.

Inf., Infundibulum.

Int., Intestine.

Int. d., Musculus interosseus dorsalis.

Int. p., M. interosseus palmaris.

Isc. flx., M. ischio-flexorius.

Isc. fm., M. ischio-femoralis.

K., Kidney.

Lar., Larynx.

Lat. d. a., Musculus latissimus dorsi anterior.

Lat. d. p., M. latissimus dorsi posterior.

Liv., Liver.

Liv. d., Liver duct.

L. ovi., Left ovary.

Lu., Lungs.

Med., Medulla oblongata.

Nos., Nostril.

Obt., Musculus obturator.

Œs., Œsophagus.

Olf. n., Olfactory nerve.

Op. l., Optic lobes.

Ov., Ovary.

Pars. hu. cub., Musculus triceps pars humero-cubitalis.

Pars. sc. cub., M. triceps pars scapuli-cubitalis.

Pan., Pancreas.

Pan. d., Pancreatic ducts.

Pb., Pubis.

P. pat. b., Musculus propatagialis brevis.

P. pat. l., M. propatagialis longus.

Pb. isc. fm., M. pub.-ischio-femoralis.

Pect., M. pectoralis, pars thoracica.

Pha., Pharynx.

Pron. s., Musculus pronator sublimis.

Pro., M, propatagialis, pars propatagialis musculi deltoidei.

Prov., proventriculus.

R., Os radiale.

Ra., Radius.

Rh. s., Musculus rhomboideus superficialis.

Rh. p., M. rhomboideus profundus.

R. ovi., Right oviduct.

Sc., Scapula.

Sc. hum. p., Musculus scapuli-humeralis posterior.

Ser. p., M. serratus profundus.

Ser. s. a., M. serratus superficialis anterior.

Ser. s. p., M. serratus superficialis posterior.

Spl., Spleen.

Sp., Spinal cord.

S. sc., Musculus subscapularis.

St., Sternum.

St. co., Musculus sterno-coracoideus.

St. tr., M. sterno-trachealis.

Sub. co., Musculus subcoracoideus.

Sup. cor., M. supracoracoideus.

T., Tongue.

Tr. lat., Musculus Tracheo-lateralis.

Tra., Trachea.

Tym. in., Membrana tympaniformis interna.

Tym. ex., Membrana tympaniformis externa.

U., Os ulnare.

Ul., Ulna.

Ul. met. d., Musculus ulni metacarpalis dorsalis.

Ul. met. v., M. ulni metacarpalis ventralis.

Urh., Urohyal.

Ur., Ureter.